Northeastern

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CIVE 7381 Transportation Demand
Problem Set #2
Due: Wednesday, October 2, 2024

Problem 1

A random sample of students was drawn in which they reported the number of vehicular trips they made in the previous day. Let y_i = number of trips made by respondent i. The sample size was n = 100. y has a sample mean of 0.43. The (true) standard deviation of the population is not known but the sample standard deviation is equal to 0.84. The trip rate (average number of vehicular trips per day) is, as stated above, 0.43.

a) What is the standard error of the average trip rate?
b) Find the 95% confidence interval of the trip rate (since the sample size is 100 you can assume normal distribution)?
c) Suppose the results of this survey are being used to plan a later survey. How large should the sample be so that the precision of the trip rate, at the 95% confidence level, will be ±0.05?

Problem 2

You are given a set of aggregate data from 57 traffic analysis zones (TAZ) in the Chicago Area (the data is quite old as you can infer from the various variables that are included and the "official" description of the variables included in the table in the next page that reflect conditions at that time). For each of the 57 zones you have available the average trips per occupied dwelling unit, the average car ownership, the average household size, and three zonal social indices. The data is contained in the file PS2-2-data.xlsx. In a later homework you will use the data to develop, using linear regression, a model that predicts the trips/day (*TODU*) generated by a household. For now, you need to do a preliminary analysis of the data and understand the main trends and relationships.

a) Describe and briefly discuss the cause/effect relationships you think are relevant for trip generation rates.

b) Present relevant statistical summaries and descriptive statistics on the data provided. Check for the presence of outliers. At the minimum, your analysis should include summary statistics (e.g. median, mode, average, and standard deviation). For the relevant variables plot their histogram, using appropriate intervals. Develop the boxplots and identify any outliers. Comment on the shape of the distributions.

c) Examine relationships between pairs of the various variables. Use scatter plots to illustrate these relationships. Calculate the correlation coefficients among pairs of variables. Do the data support the relationships you propose in a)?

The data file contains the following variables:

Name	Description
TODU	*Trips per Occupied Dwelling Unit* Trips refer to the daily frequency of person-trips via motor vehicle (auto driver or passenger) or public transit made from a dwelling unit by members of that dwelling unit. All trips whose origins were other than "from home" were ignored.
ACO	*Average Car Ownership* Cars per dwelling unit.
AHS	*Average Household Size* Number of residents per dwelling unit.
SRI	*Job/Skills Rank Index* This index reflects two elements: (i) the proportion of blue-collar workers, defined as the ratio of craftsmen, operatives, and laborers to all employees; and (ii) educational level as measured by the proportion of persons 25 years and older completing eight or fewer years of schooling. The index attains a maximum value when no residents are in the blue-collar jobs category, and all adult residents have more than eight years of education
UI	*Urbanization Index* This index reflects three elements: (i) the ratio of children under five years of age to the female population of childbearing age; (ii) percentage of women who are in the labor force, and (iii) the percentage of single units to total dwelling units. The degree of urbanization index would be increased by (a) lower ratio in (i), (b) higher percentage in ii); and (c) lower proportion of single dwelling units. High values for this index imply less attachment to the home because of fewer children, higher likelihood of women being employed, and less permanency of dwelling unit type in terms of average tenure.
MI	*Minority Index* This index is defined as the proportion of an area's residents who are minorities.

Problem 3

Read the report **Summary of Travel Trends: 2022 National Household Travel Survey** and answer the following:

a) Comment on the main trends included in Section 3: *Household Travel* and include a graph or a table summarizing that you found most surprising and explain why you found it to be surprising.
b) Comment on the main trends included in Section 4: *Person Travel* and include a graph or a table that you found most surprising and explain why you found it to be surprising.
c) Repeat the same for Sections 5, 6, and 7.
d) What are the main emerging travel trends discussed in Section 9?